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## SEQUENCE LISTING

&lt;110&gt; DSM IP Assets B.V.

5 &lt;120&gt; Microbial production of L-ascorbic acid

&lt;130&gt; 21864 WO

&lt;150&gt; EP 03017677.0

10 &lt;151&gt; 2003-08-14

&lt;160&gt; 31

&lt;170&gt; PatentIn version 3.2

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&lt;210&gt; 1

&lt;211&gt; 2367

&lt;212&gt; DNA

&lt;213&gt; Gluconobacter oxydans N44-1

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15	Thr Ser Phe Trp Pro Ser Phe Ser Arg Leu Ile Val Phe Leu Cys Val	85	90 95
20	Ala Leu Ile Ala Thr Leu Met Ala Pro Trp Leu Ser Gly Pro Gly Arg	100	105 110
25	Arg Tyr Phe Thr Arg Pro Val Thr Gly Ala Thr Ser Gly Ala Leu Gly	115	120 125
30	Ala Ile Ile Val Ala Phe Leu Ala Gly Met Phe Arg Val His Pro Thr	130	135 140
35	Ile Ala Pro Gln Asp Thr Thr His Pro Gln Glu Thr Ala Ser Thr Ala	145	150 155 160
40	Asp Ser Asp Gln Pro Gly His Asp Trp Pro Ala Tyr Gly Arg Thr Ala	165	170 175
45	Ser Gly Thr Arg Tyr Ala Ser Phe Thr Gln Ile Asn Arg Asp Asn Val	180	185 190
50	Ser Lys Leu Arg Val Ala Trp Thr Tyr Arg Thr Gly Asp Met Ala Leu	195	200 205
55	Asn Gly Ala Glu Phe Gln Gly Thr Pro Ile Lys Ile Gly Asp Thr Val	210	215 220
60	Tyr Ile Cys Ser Pro His Asn Ile Val Ser Ala Leu Asp Pro Asp Thr	225	230 235 240
65	Gly Thr Glu Lys Trp Lys Phe Asp Pro His Ala Gln Thr Lys Val Trp	245	250 255
70	Gln Arg Cys Arg Gly Val Gly Tyr Trp His Asp Ser Thr Ala Thr Asp	260	265 270

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5 Arg Leu Ile Thr Ile Asp Ala Arg Thr Gly Gln Ala Cys Thr Asp Phe  
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10 Gly Thr Asn Gly Asn Val Asn Leu Leu Thr Gly Leu Gly Pro Thr Ala  
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Pro Gly Ser Tyr Tyr Pro Thr Ala Ala Pro Leu Val Ala Gly Asp Ile  
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Tyr Asp Pro Lys Leu Asn Leu Val Phe Phe Pro Leu Gly Asn Gln Thr  
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 55 Tyr Val Arg Ala Leu Asn Thr Asp Thr Gly Glu Val Val Trp Lys Ala  
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 Arg Leu Pro Val Ala Ser Gln Ala Ala Pro Met Ser Tyr Met Ser Asp  
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 85 90 95  
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15	Leu Ser Thr Trp Ile Ala Leu Gly Leu Leu Val Ala Thr Ala Leu Trp	50	55 60
20	Ser Leu Ala Glu Val Gly Thr Ser Phe Trp Pro Ser Phe Ser Arg Leu	65	70 75 80
25	Ile Val Phe Leu Cys Val Ala Leu Ile Ala Thr Leu Met Ala Pro Trp	85	90 95
30	Leu Ser Gly Pro Gly Arg Arg Tyr Phe Thr Arg Pro Val Thr Gly Ala	100	105 110
35	Thr Ser Gly Ala Leu Gly Ala Ile	115	120
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	<212> DNA		
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	caccccacaa catcgtctcg gccctcgacc ccgacaccgg cacggaaaag tggaagtctg	180	
60	acccccacgc ccagacgaaa gtctggcagc gctgccgcgg cgtcggctac tggcatgaca	240	
65	gcacagccac ggacgccaac gcgccctgcg cctcgcgcat cgtcctcacc acgatcgacg	300	
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75	gcaacgtcaa tctcctgacc ggcctcggcc cgacagcccc cggctcctac taccgaccg	420	
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90	gggcctggga cgccaccaac ccgcatcgcg gcaccacacc actggccgaa ggcgagatct	600	
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20

Gly Asp Thr Val Tyr Ile Cys Ser Pro His Asn Ile Val Ser Ala Leu  
 35 40 45

25

Asp Pro Asp Thr Gly Thr Glu Lys Trp Lys Phe Asp Pro His Ala Gln  
 50 55 60

30

Thr Lys Val Trp Gln Arg Cys Arg Gly Val Gly Tyr Trp His Asp Ser  
 65 70 75 80

Thr Ala Thr Asp Ala Asn Ala Pro Cys Ala Ser Arg Ile Val Leu Thr  
 85 90 95

35

Thr Ile Asp Ala Arg Leu Ile Thr Ile Asp Ala Arg Thr Gly Gln Ala  
 100 105 110

40

Cys Thr Asp Phe Gly Thr Asn Gly Asn Val Asn Leu Leu Thr Gly Leu  
 115 120 125

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Gly Pro Thr Ala Pro Gly Ser Tyr Tyr Pro Thr Ala Ala Pro Leu Val  
 130 135 140

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Ala Gly Asp Ile Val Val Val Gly Gly Arg Ile Ala Asp Asn Glu Arg  
 145 150 155 160

Thr Gly Glu Pro Ser Gly Val Val Arg Gly Tyr Asp Val Arg Thr Gly  
 165 170 175

55

Ala Gln Val Trp Ala Trp Asp Ala Thr Asn Pro His Arg Gly Thr Thr  
 180 185 190



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Pro Leu Ala Glu Gly Glu Ile Tyr Pro Ala Glu Thr Pro Asn Met Trp  
195 200 205

5 Gly Thr Ala Ser Tyr Asp Pro Lys Leu Asn Leu Val Phe Phe Pro Leu  
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10 Gly Asn Gln Thr Pro Asp Phe Trp Gly Gly Asp Arg Ser Lys Ala Ser  
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	ggcgatacgg totatatctg ctacccccac aacatcgtct cggccctcga ccccgacacc	720
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	gtccgcacccg gcgcacaggc ctgggcctgg gacgccacca acccgcatcg cggcaccaca	1140
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40 Leu Gly Gly Ser Trp Phe Tyr Thr Leu Ala Gly Ile Ala Leu Ala Ala  
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45 Ser Ser Val Tyr Met Ile Arg Arg Asn Ile Leu Ser Thr Trp Ile Ala  
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50 Leu Gly Leu Leu Val Ala Thr Ala Leu Trp Ser Leu Ala Glu Val Gly  
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55 Thr Ser Phe Trp Pro Ser Phe Ser Arg Leu Ile Val Phe Leu Cys Val  
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60 Ala Leu Ile Ala Thr Leu Met Ala Pro Trp Leu Ser Gly Pro Gly Arg  
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65 Arg Tyr Phe Thr Arg Pro Val Thr Gly Ala Thr Ser Gly Ala Leu Gly  
 115 120 125

5	Ala 130	Ile	Ile	Val	Ala	Phe 135	Leu	Ala	Gly	Met	Phe	Arg 140	Val	His	Pro	Thr
10	Ile 145	Ala	Pro	Gln	Asp	Thr 150	Thr	His	Pro	Gln	Glu 155	Thr	Ala	Ser	Thr	Ala 160
15	Asp	Ser	Asp	Gln	Pro 165	Gly	His	Asp	Trp	Pro 170	Ala	Tyr	Gly	Arg	Thr 175	Ala
20	Ser	Gly	Thr	Arg 180	Tyr	Ala	Ser	Phe	Thr 185	Gln	Ile	Asn	Arg	Asp 190	Asn	Val
25	Ser	Lys	Leu 195	Arg	Val	Ala	Trp	Thr 200	Tyr	Arg	Thr	Gly	Asp 205	Met	Ala	Leu
30	Asn	Gly 210	Ala	Glu	Phe	Gln	Gly 215	Thr	Pro	Ile	Lys	Ile 220	Gly	Asp	Thr	Val
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65	Pro	Gly	Ser	Tyr	Tyr 325	Pro	Thr	Ala	Ala	Pro 330	Leu	Val	Ala	Gly	Asp 335	Ile
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10	Gly Glu Ile Tyr Pro Ala Glu Thr Pro Asn Met Trp Gly Thr Ala Ser 385 390 395 400				
15	Tyr Asp Pro Lys Leu Asn Leu Val Phe Phe Pro Leu Gly Asn Gln Thr 405 410 415				
20	Pro Asp Phe Trp Gly Gly Asp Arg Ser Lys Ala Ser Asp Glu Tyr Asn 420 425 430				
25	Asp Ala Phe Val Ala Val Asp Ala Lys Thr Gly Asp Glu Arg Trp His 435 440 445				
30	Phe Arg Thr Ala Asn His Asp Leu Val Asp Tyr Asp Ala Thr Ala Gln 450 455 460				
35	Pro Ile Leu Tyr Asp Ile Pro Asp Gly His Gly Gly Thr Arg Pro Ala 465 470 475 480				
40	Ile Ile Ala Met Thr Lys Arg Gly Gln Ile Phe Val Leu Asp Arg Arg 485 490 495				
45	Asp Gly Thr Pro Ile Val Pro Val Glu Met Arg Lys Val Pro Gln Asp 500 505 510				
50	Gly Ala Pro Glu His Gln Tyr Leu Ala Pro Glu Gln Pro Tyr Ser Ala 515 520 525				
55	Leu Ser Ile Gly Thr Glu Arg Leu Lys Pro Ser Asp Met Trp Gly Gly 530 535 540				
	Thr Ile Phe Asp Gln Leu Leu Cys Arg Ile Gln Phe Ala Ser Tyr Arg 545 550 555 560				
	Tyr Glu Gly Glu Phe Thr Pro Val Asn Glu Lys Gln Ala Thr Ile Ile 565 570 575				
	Tyr Pro Gly Tyr Tyr Gly Gly Ile Asn Trp Gly Gly Gly Ala Val Asp 580 585 590				

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Glu Ser Thr Gly Thr Leu Leu Val Asn Asp Ile Arg Met Ala Gln Trp  
 595 600 605

5 Gly Lys Phe Met Lys Gln Glu Glu Ala Arg Arg Ser Gly Phe Lys Pro  
 610 615 620

10 Ser Ser Glu Gly Glu Tyr Ser Glu Gln Lys Gly Thr Pro Trp Gly Val  
 625 630 635 640

Val Arg Ser Met Phe Phe Ser Pro Ala Gly Leu Pro Cys Val Lys Pro  
 645 650 655

15 Pro Tyr Gly Thr Met Asn Ala Ile Asp Leu Arg Ser Gly Lys Val Lys  
 660 665 670

20 Trp Ser Met Pro Leu Gly Thr Ile Gln Asp Met Pro Val His Gly Met  
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25 Val Pro Gly Leu Ala Ile Pro Leu Gly Met Pro Thr Met Ser Gly Pro  
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30 Leu Ala Thr His Thr Gly Leu Val Phe Phe Ser Gly Thr Leu Asp Asn  
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 725 730 735

35 Arg Leu Pro Val Ala Ser Gln Ala Ala Pro Met Ser Tyr Met Ser Asp  
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